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Status and Development of Clinical Informatics in Nigeria's Health Care Sector

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Abstract

This paper examines the status and development of clinical informatics in the Nigerian health care sector, highlighting the efforts to promote access to and the use of clinical informatics in Nigeria's health care sector. In a recent survey of major international research databases such as Scopus, it was observed that there is a gap in knowledge on clinical informatics in the country healthcare facilities in Nigeria due to a paucity of literature on clinical informatics. Through a literature review, the paper provides a conceptual background of clinical informatics, discusses the status of clinical informatics in Nigeria, and highlights ICT access and use in the healthcare sectors. It also examines the challenges and opportunities of clinical informatics in Nigeria. The last part of the paper discusses the implications of the reviewed literature through a PEST analysis. The paper provides invaluable information on clinical informatics in Nigeria that can be used to inform and support further studies in this growing field. The paper is a contribution to discussions and debates on the development of social informatics.

Keywords: Social informatics, clinical informatics.

Introduction

This paper is based on the premise that there is enormous potential for using clinical informatics in health care delivery in Nigeria. This usefulness will depend on an enabling environment that promotes the use of clinical informatics among medical doctors. It is believed that clinical informatics has the ability to raise the

standard of health care in the Nigerian health care sector, particularly among medical practitioners, if ICTs are properly utilized.

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The aim of this study was to examine the status and development of clinical informatics in the Nigerian healthcare sector. A literature review that un-synthesizes published work was conducted using policy documents, strategic plans, constitution, manuals, government gazettes and laws, journal articles and legislations to establish the role that the government and other organizations play in promoting clinical informatics in Nigeria's health care sector. Aside from the grey literature, the online databases EBSCO Host, Google Scholar, and Science Direct were also consulted. In order to identify relevant scientific publications that address clinical informatics development in Nigeria,

For the purposes of this review, the literature search for the study was conducted over a two–month period during April and May, 2016. An overview of the literature revealed that while research has been conducted on clinical informatics in other countries, there is a gap in knowledge due to a paucity of literature on clinical informatics in Nigeria. This study therefore sought to provide insightful knowledge on the level of adoption and use of clinical informatics in the country's health care sector.

Clinical informatics is the application of Information and Communication Technology (ICT) in all facets of medicine and the health care system (Polasek and Kern, 2012). The authors explain that clinical informatics provides medical practitioners with the tools to improve their health care services. According to the Agency for Health Care Research and Quality (2001), clinical information can be categorized into the following: electronic medical records; computerized physician order entries; computerised decision support systems; and picture archiving and communication systems. The objective of clinical informatics, as observed by Staggers et al. (2002), is to improve the health of the general population by using ICT resources in evidence-based medicine and the direct diagnosis of patients.

The contributions of clinical informatics to a medical professional or health care provider include the following: the promotion of knowledge sharing; adequate health monitoring; statistics gathering and analysis; and the delivery of effective health care services (Olatokun and Adeboyejo, 2009). Nuq (2012) identifies various ways in which medical doctors utilise clinical informatics, including: the use of clinical informatics to access professional colleagues through instant transmission/receipts and mail messages; the use of electronic file systems and power search utilities to locate information stored on millions of computers around the world; effective communication through the use of the Internet; and the diagnosis of patients. Clinical informatics provides a window of opportunity to developing nations in particular because of the introduction of ICT resources aimed at reducing epidemics and disease surveillance.

Status of, access to, and use of clinical informatics in Nigeria's Health Care Sector

Health care services are necessary in every country, particularly in developing countries where there is a rampant shortage of medical doctors (Nuq, 2012:22). The recent advancements in ICT provide the platform for innovative clinical informatics services and various opportunities for improving access to quality medical services.

With a population of 170 million people, Nigeria is the most populous nation in

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Africa (National Agency for Control of Aids, 2014:8). It is a federation of 36 states and a Federal Capital Territory, and there are 774 recognized local government areas and 9565 political wards (NACA, 2014:8). This segment addresses issues of policy, health care facilities and equipment, human resources development, and health care finance within the country.

Policy and legislation:

Considering the importance of a good health care system to the development of any nation, the National Strategic Health Development Plan Framework, 2009 - 2015 (2009:2) states that quality health care is a panacea for the development of the physical, mental, and social wellbeing of the people. The United Nations (1948) notes that good health care is one of the fundamental human rights of every man, irrespective of his or her colour, origin, education, and background. Article 25 of the Universal Declaration of Human Rights states that everybody has the right to healthy living and good health, and this includes the provision of food, clothes, shelter, accommodation, and effective medical care in the description of a good health system. This implies that it is the responsibility of the government to provide quality health care services to the people (United Nation, 1948). The United Nation's report adds that a healthy population is essential to the socio-economic development of any country.

The National Health Equipment Policy for Nigeria (2005) states that access to information and communication technology is a perquisite for a functional health care system. Consequently, there are various government policies, reports, bills, legislations, gazettes, and strategies that have been directed at the applicability of ICTs to health care delivery in Nigeria. Among them are the Federal Ministry of Health Integrated Disease Surveillance and Response Policy (2005), National Policy of Health (2005), National Strategic Health Development Plan Framework 2009-2015 (2009), National Health Promotion Policy (2005), and National ICT Policy (2010).

The National Health Promotion Policy (2005) is highly relevant to this study. The policy was designed with the intention to create a positive outcome in the health care system in Nigeria, particularly with respect to empowering medical doctors and other healthcare workers with health improvement actions through the application of ICT tools in health care delivery. The objectives of the policy include strengthening the health promotion capacity of the national health system and fulfilling the national health policy objectives of improving the health status of Nigerians as well as the achievement of health–related MGD Goals (National Health Promotion Policy, 2005). The trust of the policy indicates the need for urgent reform in the health sector, particularly on the need to access and use ICT tools in the health care sector (NHPP, 2005).

The Nigerian National Policy on Health (2005:8) emphasizes that the health care system of a country can be used to measure its productivity and level of poverty reduction. However, Nigeria's health indicators are among the worst in the world, with Nigeria alone carrying 10% of the global disease burden (National Strategic Health Development Plan, 2010 - 2015 (2010:21). The National Strategic Health Development Plan also underscores the fact that the country's health care delivery was rated 187th out of 191 countries in 2000 by the World Health Organization.

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Health care facilities and equipment

Nigeria has three levels of government, namely federal, state and local, and these three tiers of government are responsible for providing health care services to the people. The health care system is on a concurrent list which is stipulated in the country's constitution. Nigeria's health care facilities are administered by both private and public hospital managements. However, the role of the three tiers of governments are not well defined, and the functions and roles of the private sector in the health care system in the country are not clearly stated (National Policy on Public Private Partnership for Health in Nigeria, 2005).

Public health care facilities are managed by federal, state and local governments. Other types of health care facilities are non-government hospitals such as missionary hospitals and privately owned hospitals (National Human Resources for Strategic Health Plan, 2008 - 2012, 2007:15). The National Human Resources for Strategic Health Plan, 2008 - 2012 (2007) categorizes Nigeria's health care system into three, namely primary health care, secondary health care, and tertiary health care. Primary health care facilities include clinics, dispensaries and health posts that provide general health care treatment (The National Human Resources for Strategic Health Plan, 2008 – 2012, 2007). Primary facilities are staffed by nurses, community health workers, community health extension workers, and health officers. Primary facilities are under the control of local government authorities.

Secondary health facilities include general hospitals which are mandated to provide general medical services as well as specialized health care services to the people. Services such as surgery, paediatrics, obstetrics and gynaecology are provided to health care users referred from the primary health care system (NHRHSP, 2012). The services of medical doctors, nurses, and laboratory, pharmacy and health officers are always needed in secondary healthcare facilities. The secondary health care facilities are under the control of the state governments.

The National Strategic Health Development Framework, 2009 - 2015 (2009), notes that tertiary level facilities are the highest level of health care in the country. The facilities include teaching hospitals, federal medical centres, and specialist hospitals. Tertiary facilities are mandated to treat patients that are referred from primary health care and secondary health care. The facilities have various consultants from different medical fields with special expertise and a variety of ICT tools for the diagnosis of patients (National Human Resources for Strategic Health Plan, 2008 - 2012, 2007).

Oyinbocha et al. (2014:30) estimate that there are 23640 health care facilities in Nigeria. 85.8% of these facilities are primary health care centers, 14% are secondary health care centers, while 0.2% are tertiary hospitals. 38% of the total facilities are owned by the private sector, which provides 60% of the health care services in the country. There are twenty five teaching hospitals in Nigeria, which include federal medical centres (National Human Resources for Strategic Health Plan, 2008 - 2012, 2007). However no records are currently available on the total number of general hospitals that are being handled by state governments. Identifying this number would promote proper stewardship and help to develop human and material resources within the functioning health care system (National Strategic Health Development Plan Framework, 2009 - 2015, 2009).

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According to the National Health Policy (2014), adequate ICT tools should be provided to all the health care facilities in the country, particularly to teaching hospitals. In order to achieve this, the Nigerian government has agreed to create a special fund, referred to as the Basic Health Care Provision Fund, for the provision of ICT tools to all the teaching hospitals in the country. The National Health Bill (2014) indicates that 50% and 15% of the fund respectively is to be allocated to the provision and maintenance of ICT facilities in the hospitals.

Furthermore, the Nigerian Health Journal (2011) states that the Nigerian government signed an agreement with an Austrian firm in a bid to provide ICT tools to all the federal teaching hospitals in the country. The project is known as the "Federal Government/ Vamed Engineering Teaching Hospital Equipment" Project. Nwakize and Kandal (2011:687) list some of the health facilities that the government has provided to teaching hospitals to include the following: linear accelerators, 64-slice cardiac computed tomography (CT) machines, world class echo, ECGs, digital cath lab, medical imagery and diagnostics equipment, infusion pumps, medical stainless, electrostatic dissipative, spectrophotometers, fluoroscopy machines, magnetic resonance imaging (MRI), and incubators. The hospital equipment initiative of the federal government of Nigeria seems to demonstrate its commitment to the improvement and overhauling of the health sector by providing relevant ICT tools for improved medical procedures.

Nevertheless, the Nigeria Project Agenda (2010) revealed that access to health care facilities in the country is very low, claiming that only 3 out of 5 Nigerians have access to adequate health care facilities.

Human resources development

Human resources for health care delivery are the basic tenets of the health care system. The National Strategic Health Development Plan, 2010 - 2015 (2009:37), asserts that healthcare delivery cannot flourish without an effective workforce. These include medical doctors and other support workers who enable the health system to function .The number of medical doctors determines health productivity and result drive (National Human Resources for Strategic Health Plan, 2008 – 2012, 2007:14). According to Nigeria Mobile World (2014), there are 71,740 medical doctors who are registered with the medical regulatory body. About 27,000 are practicing within Nigeria, while 7,000 are working in public health institutions in foreign countries like Britain and America. Others have left the profession for better working opportunities (Nigeria Mobile World, 2014).

Nigeria has 25 accredited medical colleges that are unequally distributed across the country. 75% are located in the southern part of the country, while almost 17 states in the country do not have a medical college (National Strategic for Health Development Plan, Framework 2009 - 2015, 2009:10; Adindu and Asuquo, 2013:3). The National Human Resources for Strategic Health Plan, 2008 - 2012 (2008:19) reveals that there is an average of one doctor for every four primary health care facilities; an average of 6 doctors per secondary health facility; and an average of 65 medical doctors per teaching hospital. The National Strategic Health Development Plan Framework, 2009 - 2015 (2009:39) notes that the majority of the medical doctors in Nigeria are working in the private sector, while about 12% of the medical doctors trained in the country are working in foreign countries.

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Other than the number of health care providers, human resources development also means that health care providers, especially doctors, should be adequately trained to function in the health care system. Therefore, the National Health Bill (2014:19) states that the government is mandated to ensure that there are adequate resources for the training and retraining of medical doctors and other health workers working in the country. In order to meet the demand for medical doctors in the health care sector, the federal government has mandated the Federal Ministry of Health to employ more medical doctors from other countries and facilitate their training (National Health Bill, 2014:19).

Health financing in Nigeria

As mentioned earlier, the health sector is on the concurrent list in Nigeria's Constitution, which means that each tier of the government budgets for its own health care needs. The federal government provides budgetary allocation to teaching hospitals, while state governments handle secondary health care facilities such as general hospitals or comprehensive hospitals, and local government authorities handle the budgetary allocations to primary health care centres (National Human Resources for Health Policy, 2006:15).

NHRHP (2006:15) highlights various health care functions that the government funded in the year 2008, including preventive measures against diseases, curative and rehabilitative services, occupational health and capital formation, research, and health development. The health worker country profile (2008:20) reports that in 2008, curative care recorded the highest health care spending in the year 2010, accounting for 175.5 billion naira or 68.49% of the total health expenditure, while preventive care came second with 2.2 billion naira, accounting for 0.9% of the total health expenditure. Capital formation brought up the rear with less than 0.31%, while 29.93% of the budget was grouped as 'other'.

The WHO (2005) recommends that $54 (2005 exchange rate) should be the minimum that the government should spend on health-related issues per person. Soyinbo, Olaniyan and Lawanson (2009) estimate Nigeria's total government health expenditure as a proportion of the total health expenditure, which was put at 18.69% in the year 2003, 26.40% in 2004 and 26.02% in 2005.

Imoughele and Ismaila (2013) observe that the total government expenditure on the health sector in the years 1986, 1990, 2000 and 2010 was N360.4m, N 558.1m, N18181.8m and N149269.8m respectively. The capital expenditure, on the other hand, reveals the same continuous increase in trend from 1986, 1990, 2000 and 2010 of N18.2m, N157.0m, N6569.2m and N46649.8m respectively. Similarly, the recurrent expenditure on health reveals continues increase in value from 1986, 1990, 2000 and 2010 was N279.2m, N401.1m, N11612.60m and N102.620m respectively.

However, Alabi et al. (2011) observe that less than 1% of the GDP was allocated to health care from 1986 to 2010. According to the Federal Ministry of Finance, the allocation to health was increased to 5.6% of the GDP in 2013 and 6.5% in 2015 (Federal Ministry of Finance, 2013; Federal Ministry of Finance. 2015). The Federal Ministry compares Nigeria's budgetary allocation to other economies of West African States (ECOWAS), such as Sierra Leone, Mali, Niger, Burkina Faso, Senegal

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Benin, Togo, Liberia, Ghana, Cape Verde and Gambia, and reveals that these countries budgetary allocations to health care are higher than Nigeria's. This is surprising because Nigeria is one of the signatories of the Abuja Declaration in 2001, where African Heads of State agreed that 15% of the annual budget should be allocated to the health sector United Nations Programme on HIV and AIDS (2013:4). The implication is that although budgetary allocation to the health sector has increased, a lot of consideration still needs to be given to the tools, manpower and facilities that could improve the health care sector and ensure that the best services are available to all.

In order to promote the adequate funding of health care service delivery, the government recently introduced the National Health Insurance and National Health Bill to dedicate more funds to health care in the country (United Nation Foundation, 2014).

ICT access and use in Nigeria's Health Care Sector

ICT for health refers to any tools that promote the processing of information by electronic means for the purpose of improving mankind. Gargon et al. (2012) observe that ICTs have become essential in medical practice because the amount and complicity of knowledge and information have outstripped the ability of medical doctors to function optimally without the support of relevant information and communication technology.

The introduction of ICT into the health sector in Nigeria can be traced back to INDEHELA, a research project on informatics development for health in Africa that was carried out by the Computer Centre of University of Kuopio and Obafemi Awolowo University Teaching Hospital (OAUTH) in the late 1980s. The project introduced the use of ICT in health care delivery in Nigerian teaching hospitals through the implementation of Computerised Admission Discharge Transfer at OAUTH in 1991. In another development, in 2003 a software package was developed by the Computer Science Department of Obafemi Awolowo University, Nigeria, referred to as the State Hospital Network (SHONET), for the sharing of hospital resources over computer networks in the country (Idowu et al., 2008). The objective behind the project was to reduce the cost of running hospitals in the country. The National Strategic Health Development Plan Framework, 2009 - 2015 (2009) also notes that over time, many donor agencies have donated computers and other ICT tools for use in the health care sector, particularly in the area of record and information management and the use of electronic-based ICT systems.

In listing various advantages of ICT access and use in health care delivery in Nigeria, the National Health Management Information System Policy Programme and Strategic Plan of Action (2007) states that ICTs lead to: better decision making by medical doctors; effective allocation of resources; effective disease management; and better quality of life. Odini and Omuke (2014:155) likewise note some of the areas in which ICT can be applied in health care, citing decision making, provision of adequate medical information, and dissemination of health information for medical education and research. The provision of up-to–date information and effective communication between professional colleagues in the medical field can only be successful through the effective use and application of ICTs.

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Nigeria's National Broadband Plan, 2013 - 2018 (2012) notes that ICT access and use by medical doctors can offer solutions to many medical problems, improve health care outcomes, reduce costs, and improve the efficiency of communication between medical doctors and their patients. The use of ICTs in health care gives patients in many jurisdictions the opportunity to communicate with their medical doctors via the e-mail, Internet, and video consultations rather than through traditional face-to-face consultations (NNBP 2013-2018, 2012). Various ICT applications that can be very useful in health care delivery, as noted by Odini and Omuke (2014:156), include telecommunication, teleferrals, teleradiology, electronic health records, computerized physician orders, and imagery archive systems (Odini and Omuke, 2014:156). The United Nation Foundation (2014) categorizes ICT initiatives in health to include *SMS* based applications, Internet based applications, Internet based interaction applications, and high speed Internet.

The WHO (2008) states that ICT is used in health care delivery to support health care by preventing diseases, diagnosing diseases, and managing diseases. Druy (2005) and Bukachi and Pankenham-Wash (2007:1627) specify that ICTs are fundamental in modern healthcare because they can improve isolated communities' access to health care, provide support to medical doctors, assist in knowledge sharing, provide visual tools that can link the population for the dissemination of environmental information on disease outbreaks, and provide an effective electronic means for data capture, storage, interpretation, and management.

Afolayan and Oyekunle (2014:11) conducted a study on availability, accessibility, and the use of ICTs by health workers in Nigeria. 70% of the respondents stated that they used Internet resources and accessed the tools outside the hospital for the purpose of seeking information. Half of the respondents claimed that they had been using ICT tools over the last five years. Asagnasi et al. (2008:11) likewise conducted a study on computer use among medical doctors in a teaching hospital in Nigeria. The findings revealed that all the medical doctors had access to the Internet, but the predominant place of access was the cyber café. Only 51% of the respondents owned personal computers. When asked about challenges in accessing medical records, 41.4% of the respondents stated that computer-based recording systems are better than manual based recording systems. They also stated that they always had problems with checking patients' records when using the manual-based recording system.

Challenges of ICT access and use in Nigeria's Health Care Sector

There are many issues facing ICT access and use in Nigerian hospitals, in particular: policy issues, paucity of ICT infrastructure, funding problems, poor maintenance culture, a shortage of medical doctors, and a poor power supply.

Policy issues

A policy is a course or principle of action adopted or proposed by an organization or individual for bringing about a desired course of principle or action (United Nations Foundation, 2014). Policy issues are a serious challenge to the implementation and development of ICTs in health care delivery. The National Policy on ICT (2012) observes that there are various uncoordinated policies and laws guiding different facets of ICT development in

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Nigeria, rendering them ineffective in providing adequate support for real ICT development in the country. The lack of clear government policies and strategies on ICT and health care delivery has led to the slow uptake of technology in the health sector. This has affected the adoption and implementation of ICTs for the advancement of health care services. Where the initiative has been implemented, there has not been adequate monitoring and evaluation (Ouman and Herselmean, 2008). It is important for the government to provide adequate policy documents to support the use of ICTs in health care delivery, particularly by medical doctors.

The United Nations Foundation (2014) observes that none of the existing policy documents in Nigeria pay serious attention to ICT access and use for effective health care delivery. The National Strategic Health Development Plan Framework 2009-2015 (2009) likewise observed that while successive governments have strived to improve the health sector through a series of policies and reports, none of the reports have made adequate plans for ICT implementation and development. There has been policy inconsistency with respect to ICTs because different governments introduce different or new policies that do not correspond with existing ones, thus affecting the development of ICT in the Nigerian health sector (Oyegoke, 2013:9). The United Nations Foundation (2014) also notes that there is a need for an e-Health strategy policy plan or framework in Nigeria.

Paucity of ICT infrastructure

Ezeamalu (2010) opines that ICT access and use in hospitals is a panacea for developing new ways of providing better health care services. He attributes this to the massive innovations in ICTs over the past 10 years that have brought about significant changes to health care services. The quality of health care services in a country is measured by the level of ICT infrastructure possessed and used in the health care sector (Hassan, Siyanbola and Oyebisi, 2011: 296). Therefore good ICT infrastructure in health care delivery is a requirement for promoting the wellbeing of a country.

The development of ICT infrastructure is essential to a modern and effective health care system. The United Nations Foundation (2014) describes ICT infrastructure development as concerned with all aspects of connectivity, electricity, hardware, and software that facilitate the use of ICTs in health care delivery (UNF, 2014). The paucity of ICT infrastructure in Nigeria's health care system has hampered the provision of efficient and affordable access to clinical informatics in the health sector, which has affected the quality of health care in the country (UNF, 2014).

According to Research ICT Africa (2012), Internet and broadband have been globally acknowledged as a strong foundation for transforming the health sector and promoting access to and the use of ICT in health care, particularly among medical doctors (ICT Policy, 2012). Nigeria reportedly has the highest total number of Internet users of any country in Africa, with 48.4 million users recorded in the year 2012, leading Egypt (29.8 million), Morocco (16.5 million), Kenya (12 million) and South Africa (8.5 million) (Internet World Stats, 2012). Yet, the broadband in Nigeria barely covers 20% of the population (Nigeria's National Broadband Plan, 2013 – 2018, 2012). Quality health care services and ICTs also cannot be sustained in Nigeria without an adequate and pervasive power supply, discussed later.

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Funding problems

Funding is a problem that many professionals face, particularly with respect to ICT access and provision. Gbadamosi (2006) notes that inadequate funding is one of the main challenges militating against ICT access and use in Nigeria. The poor level of health funding in Nigeria and reduced budgetary allocation to the health sector has constrained the provision of ICTs. An examination of public expenditure on health in the country's budget indicates that the allocation to health care has been rather low. The percentage of public health expenditure on total government expenditure, according to the World Health Organization, in 1995, 2000, 2005, and 2010 was 7.05%, 4.22%, 6.41% and 4.4% respectively (Imoughele and Ismaila, 2013:221). This implies that more provision should be made for the Nigerian health care system in terms of budget allocation.

Poor maintenance culture

Many hospitals and health institutions in Nigeria are facing maintenance challenges with their ICTs (National Health Equipment Policy, 2008). Obansa and Orimisan (2013) observe that good health services in the country depend on the availability of functional ICT tools for diagnostic and treatment purposes. The authors go on to explain that most hospitals in Nigeria lack ICTs, and those that do have access to them, have them in short supply.

The National Health Equipment Policy for Nigeria (2005) revealed findings from a national survey of ICT use in government hospitals in Nigeria that showed that 5% of the ICT tools in government hospitals were not installed, another 5% were installed but not formally put to use, while only 10% of 90% of the ICT tools in the government hospitals were fully functional. The research identified the factors that are responsible, including: failure to comply with instructions on installation requirements, and time wasted between the time of procurement, installation, and formal declaration of use, leading to outdated tools.

Shortage of medical doctors

Human resources are the heartbeat of effective health care services in a country. The Nigerian health sector is facing a serious human resources challenge, most notably with regard to the misdistribution of available medical doctors within the health sector and the increase in brain drain which has resulted in a shortage of critically needed medical doctors. National Human Resources (2006) affirms that adequate medical doctors are essential to the provision of quality and effective health care services in the country.

There are 39210 registered medical doctors in the country. Despite the fact that the country has the largest pool of medical doctors in Africa, the 39210 doctors translate to 30 doctors per population of 100,000 (NHRHP, 2008 - 2012, 2007). This poor ratio of medical doctors to the population may be attributed to various factors, including but not limited to poor working conditions, lack of equipment, poor conditions of service, delays in promotion, poor placement after training, inadequate opportunities for professional advancement, and unfavourable civil service rules (NHRHP, 2008 - 2012, 2007).

The government is committed to capacity building with ICTs in other ministries, but ICT skills training in the health sector, particularly for medical doctors, is lacking (United Nation Foundation, 2014). In their study, Olasina and Popola (2014)

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determined that medical doctors in Nigeria have low perceptions about the use of ICT in health care delivery. (Notes: this could be a separate challenge – poor attitude towards ICTs) They attributed this to poor ICT infrastructure and the inadequate training of medical doctors.

Poor power supply

Nigeria's power generation capacity is estimated to be 6,000 megawatts, with an average working capacity of 2,000 megawatts for the provision of electricity to over 150 million people (FGN, 2013). Nigeria has been struggling to supply adequate power for over two decades, and the power supply in the country is characterized by frequent power cuts (Alawiye, 2011). The lack of a steady power supply in the country reduces the essential energy that is necessary for the operation of ICT tools in the health care sector.

The critical impact of the shortage of electricity on ICT projects has been expressed by Idowu et al. (2004), who note that the unstable power supply to hospitals in Nigeria can cause damage to ICTs in hospitals.

Telecommunication problems

The Nigeria National Broadband Plan, 2013 - 2018 (2012), asserts that while telecommunication is a very important pillar in the use of information and communication technology in the health sector, presently there are a lot of challenges, such as the high cost of the right of infrastructure, damage to fibre infrastructure, and cable theft. Idowu et al. (2008) identify inadequate telecommunications facilities as one of the challenges facing ICT use in the health sector. The authors' further state that despite the highly rated telecommunications sector in the country, the majority of health care facilities have no access to the Internet and operate on low bandwidth.

ICT opportunities in Nigeria's Health Care Sector

There are many opportunities that ICTs can bring and have brought to Nigerian teaching hospitals, among them: guiding innovation in the health care system; supporting ICT infrastructure development; promoting health care intervention and promoting capacity building.

Guiding innovation in the health care system

ICT application in health care delivery also provides diverse opportunities for the development of reliable human resources, particularly among medical doctors who are able to expand their skills, increase their job satisfaction, and improve the efficiency of medical tasks (National Information Technology Policy, 2012).

The networking of all health care facilities, compulsory ICT training for medical doctors, and software development, are just some of the government initiatives motivated by the promotion of ICT in health care in Nigeria (National Health Policy, 2005:23). Various innovative projects involving ICTs have also been implemented in the health care sector in the country, such as the National Health Management of Information, Abiye Safe Motherhood, the Community Surveillance System, Clinical Pack 360, Mobile Health Applications, and the Distributed Electronic Clinical System (United Nation Foundation, 2014:34).

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Supporting ICT infrastructure development

The provision of quality health care services in a country is guided by the level of access to and use of ICTs by medical personnel in the country (Awopetu et al., 2014:69; Olatokun et al., 2009:183). Following the push for ICT in health care delivery, quite a number of teaching hospitals have subsequently been provided with various ICTs, such as the Internet (Hassan, Siyanbola and Oyebisi, 2011:297). (Notes: contradicts statements that say there is a lack of infrastructure)
The government has harnessed the opportunities of ICT in health care delivery by providing relevant infrastructure and upgrading the ICT equipment in teaching hospitals across the country. This demonstrates the commitment of the government towards overhauling the entire health sector by equipping teaching hospitals with state-of-–the-art medical equipment (Nwoko, 2011).

Promoting health care intervention

The government is partnering with various organizations on ways to reposition the health care sector. The public private partnership (PPP) of the government has proved to be very effective in promoting a health care system where investors are encouraged to establish and operate theatres, diagnostic units and ICT facilities within teaching hospitals on "build, operate and transfer" (BOT) terms (Ukwoma and Muracy, 2002). The authors go on to list some of the ICT/ PPP projects at some of the teaching hospitals in Nigeria, such as Automated Open Heart Surgery at the University of Nigeria Teaching Hospital, Enugu, and University College Hospital (UCH), Ibadan, Nigeria.

Promoting capacity building

The National Policy on Public Private Partnership for Health in Nigeria (2005:20) observes that many doctors in Nigeria cannot operate various ICT tools in hospitals due to inadequate training and poor medical curricula in medical schools. The federal government has agreed to employ the service of private ICT firms to organize ICT training opportunities (National Policy on Public Private Partnership for Health in Nigeria, 2005:20). In order to achieve the effective ICT training of medical doctors, the government has allocated 10% of its health allocation budget to the ICT training of medical doctors (National Health Bill, 2014:12) The National Information Technology Policy (2012:31) clearly states that ICT training has been made compulsory for medical doctors working in all government hospitals (NNBP, 2012).

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Discussions and implications

Information and communication technology has brought positive changes to all human endeavours, and this also applies to health care delivery. ICTs can be used to obtain information and diagnoses as well as for evidence-based medicine and clinical information support systems. Adequate access to clinical information is essential for effective health care services.

This section uses PEST (political, economic, technological and social) analysis to discuss the development of clinical informatics in relation to social informatics in Nigeria. Kotler (1998) claimed that PEST analysis is a useful strategic tool for understanding market growth or decline, business position, potential and direction for operations. PEST analysis is usually employed in health care systems, business

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and strategic planning, and research. Ciocoiu et al. (2013) observe that PEST has been employed in various academic studies on the status and development of ICT in various countries. PEST in this discussion is Political, Economic, Social and Technological.

The political climate

The political climate is one of the main determinants of social informatics development in any society. That said, Nigeria's political climate has a great influence on the prevailing ICT status in the country, particularly in the health sector. In promoting the use of clinical informatics in Nigeria's health care system, the policy issue needs to be addressed. As noted earlier, there is apparent inconsistency in different governments' introduction of policies that do not align with existing ones.

Specifically, the effective implementation and use of clinical informatics in health care service delivery needs to be anchored on policies that are adopted by all levels of government, private health providers, and allied workers. The policy documents should also indicate the role of the government and other stakeholders in the effective implementation of ICTs in the health care sector.

Furthermore, the government needs to provide visionary leadership and strategic plans that promote the use of technology in the country's health care system in order to save the lives of people. The need for government policies on ICT use in health care is paramount because government policy documents would leverage the development of clinical informatics and improve ICT access and use in the country's healthcare delivery in order to promote effective services.

Based on the literature reviewed for this paper, it is believed that in designing the policy documents on ICT use in health care, the following must be taken into account:

1. The policy documents need to consider the interests of health care users, medical doctors, and allied workers in the sector and describe the ways the government could provide interventions with regard to ICT in health care delivery.
2. The government policies on ICT and health care need to be supported with legal documents to ensure that the targets are met and to improve the quality of health care delivery.
3. The policy needs to be tailored towards the development of clinical informatics.
4. There must be a regulatory body that will ensure compliance with and the enforcement of the policy documents on ICT in health care delivery. This is necessary because poor leadership and ineffective monitoring have been the basis for the unsuccessful implementation of most government policy programmes on health care. Consequently, political stability and effective monitoring are very necessary in supporting the effective implementation and use of ICT in health care service delivery in Nigeria.

Lastly in order for clinical informatics to foster development in Nigeria's health care system, there has to be political willingness on the part of the government to create an enabling environment for ICT adoption and application.

Economic factors

In order to effectively implement clinical informatics in Nigeria, there is a need to consider the state of economic activities in both the short and the long term. This has become necessary, particularly when

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comparing the status of clinical informatics in the country to that of other nations. The economic benefits of ICT are enormous, both as a growing industry in its own right and in terms of its influence on economic development. Studies by Adomi (2006) and Anie (2011) confirm that there is a close relationship between ICT use and economic development in Nigeria's health care system, and that ICT has contributed positively to the development of the health care sector in Nigeria. The authors also found that the impact of ICT on health contributes to the growth of the economy.

In order to promote access to and the use of clinical informatics in the country's health care sector, economic considerations such as sufficient budgetary allocation and human resources development need to be taken into account. The manner in which a country finances its health care system is a good indicator of the types of ICTs that will be available. A good health care financing strategy must strive to avail all the resources necessary to achieve an effective and quality health care system. The poor funding of Nigeria' health care system has resulted in the inadequate provision and non-maintenance of health care facilities, including ICT tools. Eneji et al. (2013:258) suggest various ways by which the government could generate funds for the health sector, including seeking external loans from other countries and grants from international donor agencies and non-governmental organizations (NGOs); a National Health Insurance Scheme; and taxes from the private sector.

The migration of medical doctors to other countries in search of greener pastures has resulted in massive brain drain which has created a demand gap in the country's healthcare delivery. The problem of brain drain is the fall-out of economic depression, and if not properly addressed, will continue to obstruct the development of effective healthcare services in the country. However, there is a need for motivation in form of better salaries, provision of a conducive environment, and the availability of relevant resources to encourage medical doctors and other health workers in order to achieve quality healthcare services in the country.

An adequate power supply is also vital to the socio-economic development of any nation. A country that finds it hard to provide constant power to its health care facilities will definitely face challenges in the deployment of ICT resources. An unsteady power supply can also cause damage to various ICTs**.** The Nigerian government needs to provide a steady power supply as a necessary perquisite for effective health care delivery. This would also build confidence in the medical doctors' usage of clinical informatics. However, the challenges in the supply of electricity across various health facilities in Nigeria are enormous. To resolve some of these challenges, the government needs to enter into a bilateral agreement with developed countries and multinational companies on ways to improve the power supply.
In addition, high cost of clinical informatics tools and other medical equipment also contributes significantly to the cost of healthcare system delivery. To tackle these high costs, the government needs to subsidiary health care equipment particularly clinical informatics tools.

Social factors

Public/private partnerships need to be encouraged in order to promote ICT use for effective health care delivery in the country. The government, at all levels, needs to encourage private organizations to build a

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modern diagnostic centre under the auspices of 'build, operate and transfer'. This would enable more health care users to benefit from clinical informatics and other health care facilities.

Technological factors

The most prominent technological issues identified in the literature review was infrastructure development. The infrastructure aspect is concerned with various ICT components, such as connectivity, hardware and software. The contributions of these aforementioned components to effective health care delivery are very important.

The use of clinical informatics in health care delivery has become a crucial factor in promoting health care delivery around the world today. Despite this, clinical informatics has barely taken a foothold in Nigeria's health care sector. Poor ICT training and lack of ICT infrastructure are widely recognized as increasingly insurmountable obstacles to the development of clinical informatics resources in Nigeria's health care system. Therefore, it is very necessary to organize ICT training and ensure computer literacy so that medical personnel can operate the relevant systems effectively and with ease. New technologies and changes in usage can affect access to technological use. Many medical doctors are familiar with old infrastructure the need to change or upgrade the system can create problem and hamper the technology adoption.

However, effective health care service delivery in Nigeria requires functional and adequate clinical informatics resources. These resources will assist medical doctors in making clinical decisions.

Overall, there is a need for the government and private organisations to collaborate on ways to improve clinical informatics infrastructure in the health care system.

Conclusion

The access to and use of ICT tools among medical doctors in Nigeria healthcare delivery minimize the risk of medical errors and helps in the early detection of health problems., ICTs have also been discovered to promote best practice, improve procedures, and motivate innovation and development in the health care sector. Investment in clinical informatics could promote effective healthcare services in the country. The government needs to find lasting solutions to various challenges facing the development of healthcare system range from inadequate facilities, shortage of personnel, and electricity. These and other challenges need to be overcome in order for the country's to enjoy the benefit of clinical informatics use in promoting evidence based medicine**.**

However, in order to ensure better exploitation of clinical informatics in Nigeria healthcare sector, the government at all levels must invest heavily in acquisition of clinical informatics resources which involve both hardware and software. This become necessary because functional healthcare system will reduce emigration of health personnel particularly medical doctors for greener pastures and create a new revenue stream for the country through those that will come to the country to seek solutions to their medical challenges.

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References

Adindu, A., and Asquo,A., (2013). Training human resources for the 21st century Nigeria Health Sector. *Global Journal of Human Resources Management* 1(3): 1-11.

Afolayan, O. T., and Oyekunle, R. A., (2014). Availability, accessibility and frequency of use of ICT tools by health professionals in Ilorin Metropolis. *Covenant Journal of Informatics and Communication* 2(1):1-26.

Agency for health care research and quality (2001) Clinical informatics to promote patient safety. Available from: http://grants.nih.gov/grants/guide/rfa-files/RFA-HS-01-006.html Accessed on 7th August, 2014.

Alabi, R. A. Adams, O. O. Chime, C. C. and Aiguuomudu, F. (2011) Marginal benefit analysis of public spending in Nigeria. PEP-PMMA Working Paper, 457

Alawiye, A., (2011). The power sectors industrial development in Nigeria Case; Power Holding Company of Nigeria. Thesis submitted for Bachelor Degrees programme in International Business Autum , Lanti University of Applied Sciences

Anie, S. O., (2011). The Economic and social benefits of ICT policies in Nigeria. *Library Philosophy and Practice*. Paper 457.

Awopetu, R. G. Anhanye. S. and Ocheibi, V.A. (2014) . Perceived influence of ICT in clinical service delivery among care givers and patients in Makurdi metropolis. *Research on Humanities and Social Sciences* ***4*** (17): 69-73.

Ciocoiu N., Hîncu D., Dobrea C., Valentina Târţiu V., and Burcea Ş., (2013). Driving force of WEEE management: a PEST analysis of Romania, *Environmental Engineering and Management Journal*, 12, 535-548

Ezeamalu, B., (2010). Deploying ICT in health care delivery available at jajuwa-imaging.com/ICT/.htm

Federal Capital Territory (2012). MDGs Mailafiya Achieving MDG 4, 5, 6 ,Federal Capital Development Authority

Federal Government of Nigeria, (2013). Road map for power reform, Presidential Task force in Power Federal Ministry of Power, Abuja.

Federal Ministry of Finance. (2013). 2013 Budget, Federal Ministry of Finance, Abuja

Federal Ministry of Finance. (2015). 2015 Budget . Federal Ministry of Finance, Abuja.

Federal Ministry of Health Intergrated disease surveillance and response policy.2005. Abuja

Gbadamosi, L., (2006). Challenges of e-teaching profession and way forward : An educational planner view paper presented at ICT workshop. Oragnised by Teacher Registration Council (TRCN) Adeniran Ogunsanya College of Education, Ijanikin, Lagos 2nd -8th July.

Health Workforce Country Profile for Nigeria (2008) Federal Ministry of Health, Abuja.http://www.unaids.org/sites/default/files/media_asset/JC2524_Abuja_report_en_0.pdf. Accesses on 13th April,2015.

Idowu, B. Oguunbodede, E. And Idowu, B., (2003). Information and communication technology in Nigeria: The Health Sector

© 2018 The Author(s), Medical Library Association of Nigeria (MLN-NG).

experience. *Journal of Information Technology Impact* 3(2): 69-76.

Idowu, D. C. Cornford, D. and Batin, L. (2008.) Health Informatics development in Nigeria. *Journal of Health Informatics in Developing Countries* 2(1): 15-33.

Imoughele, L, and Muhammed, I., (2013). Determinants of public healthcare expenditure in Nigeria: an error correction mechanism approach .*International Journal of Business and Social Science* 4(13).

Inter World Stats (2012) Internet usage statistics for Africa .Available on http://www.internetworldstats.com/stats1.htm. Accessed on 7th May, 2015.

National Agency for Control of Aids (2014) Global Aids response Country Progress Report Nigeria .Federal Ministry of Health, Abuja.

National Health Bill (2014), Federal Ministry of Health, Abuja.

National Health Equipment Policy for Nigeria Draft (2005). Federal Ministry of Health, Abuja.

National Health Management Information System (NHMIS) Unit Revised Policy Programme and Strategic Plan of Action (2007) Federal Ministry of Health, Abuja

National Health Promotion Policy (2005) Federal Ministry of Health, Abuja

National Human Resources for Health Strategies Plan 2008-2012., 2007.Federal Ministry of Health, Abuja.

National ICT Policy, (2010), Federal Ministry of Communication Technology, Abuja.

National Information and Communication Technology ICT (2012). final Draft Policy, Federal Ministry of Communication, Abuja.

National Policy on Health (2005) .Federal Ministry of Health ,Abuja.

National Policy on Integrated Disease Surveillance and Response, (2005). Federal Ministry of Health, Abuja .

National Policy on Public Private Partnership for Health in Nigeria 2005. Federal Ministry of Health, Abuja.

National Strategic Health Development Plan Framework (NSHDP) 2009-2015, 2010. Federal Ministry of Health, Abuja.

Nigeria Mobile World, (2014). Nigeria Must Use ICT to drive national e-health policy strategy, Federal Ministry of Health, Abuja.

Nigeria National Broadband Plans in Nigeria 2013 -2018, 2012 Federal Ministry of communication, Abuja.

Nigeria Project Agenda, (2007) Nigeria Project and shared aspiration. Available on http:// site resources. World bank.org/Nigeria EXTN/Resources /7points_Nigeria pdf, 13 April,2015.

Nigeria Project Agenda, (2010). Nigeria project and shared aspiration Available at http://www.ab.xlibx.com/1economy/6361-1-table-contents-abstract-introduction-the-nigeria-project-and-s.php. Accessed on 6th June, 2014

Nigerian Policy on Health, (2005). Federal Ministry of Health, Abuja.

Nuq, P. A., (2012) Toward a better understanding of intention to use ehaealth services by medical professional's the case of developing countries. A Phd thesis submitted to the department of Business Administration, University of New Castle.

Nwoko, I., (2011) Transforming healthcare delivery in Nigeria. The Vanguard, December, 2nd.

© 2018 The Author(s), Medical Library Association of Nigeria (MLN-NG).

Odini, S and Omuoke, A., (2014). Use of ICT by medical professionals in accessing information for healthcare delivery at Moi Teaching and Referral Hospital MTRN) in Eldoret Kenya. *Journal of International Academic Research for Multidisciplinary* 2(5): 153-180

Olasina, G. and Popoola, T. (2014). Predictors of the use of e-medicine by medical doctors. *Journal of Health and Medical Informatics* 5(4) 12-20.

Olatokun, M. and Adeboyejo, C. (2009). Information and communication technology use by reproductive health workers in Nigeria: state of the art, issues, and challenges. *An Interdisciplinary Journal on Humans in ICT Environments* 5(2), 181-207. Available from: http://www.humantechnology.jyu.fi/archives/abstracts/olatokun-adeboyejo09.html. Accessed on 8th September, 2014.

Oyegoke .L.(2013) Adoption and utilisation of ICT in Nigeria Hospitals(Government) Bachelor degree Project submitted to Department of Business IT HAGGGA –HELIA University of Applied Sciences

Polasek, O., and Kern, I., (2012). Medical Informatics Scientific output in 35 Europeans Countries, *Informatics for Health and Social Care* 37(1):12-22 Available from: http://www.ncbi.nlm.nih.gov/pubmed/21999433 . Accessed on 7th July, 2014.

Soyinbo. A.. Olaniyan.O. and Lawan.O., 2009. National Health Accounts :structure trends and sustainability of health expenditure in Nigeria. African . *Journal of Economics Policy* 14(1): 83-109.

The Intel Health IT Value Model (HITVM) for Developing Nations ,2012@ Addresses the specific concerns of Developing Nations.

Ukwoma, B. and Muracy, C., (2002). Government begins N1.36 upgrading programme for 15 hospitals .The Guardian Newspaper, Friday, February, 29th pp. 30.

United National Foundation, (2014). Assessing enabling Environment for ICTs for Health in Nigeria: a review of policies. United Nation Foundation in Support of ICT 4SOML.

Universal Declaration of Human right (1948),United National Organisation

World Health Organisation, (2005). Connecting for health global vision, local insight : report for world summit on the information society. WHO press, Geneva.

World Health Report, (2006). Working together for human health. Available on who.int/wnr/2006/who6_en.

World Health Report, (2007). A safer future: global public health security in the 21st century. .WHO press. Geneva

World Health Organisation, 2008. Information Technology in support of healthcare. Available on http;// www.who.int/eht/en/information Tech pdf.. Accessed on 13th May, 2015

World Health Organization World Health Report 2000 Health Systems: Improving Performance.http://www.who.int.proxy.lib.uwo.ca:2048/whr/2000/en/whr00_ch4_en.pdf

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